enocean® alliance

No Wires. No Batteries. No Limits.

EnOcean Alliance Members Meeting

Technical overview

Marian Hönsch / Technical Working Group

05.04.2018

Agenda

Technology Explained in few slides

Organization: How the TWG Works & 2018 Programs

Roadmap Focus 2018, Technology & Programs

IoT

- EnOcean over IoT, Next gen EEP,
- Product Database
- Standard product Labels

Focus 2018

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Technical Task Groups

Remote Commissioning

EEP – Communication Profiles

Security

Product Labeling

Ongoing Technical Programs

EEP Approval Committee

Certification Program

Strategic initiative

EnOcean IoT

Technology Explained in few slides

Protocols:

- EEP / Signal Telegram
- Remote Management – ReMAN
- Remote Commissioning - ReCOM
- Smart Acknowledge
- Security / Encryption
- Next gen EEPs – Ideas
- EnOcean over IP

Product definitions

- Certification
- EOA Labeling
- Electronic Datasheet

Protocol Stack
Application
EEP
RECOM - REMAN
REMAN
Smart Acknowledge
Security
EnOcean Radio Protocol 1 & 2
868.3, 902, 928 MHz (Radio)

Smart acknowledgement between the sensor and the actuator

EEP(EnOcean Equipment Profile): to know what kind of device, you're actuating

Application Layer, gives the provision to potentially develop some applications, if we decide to use the complete protocol stack

Remote Commissioning

Remote Management – REMAN

Remote Commissioning

Remote Management

SYS_EX telegram:Telegram with a Specific structure

Remote Commissioning (RECOM) :

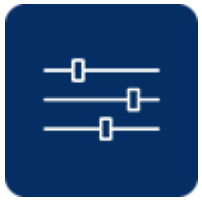
- Builds on REMAN
- Defined new function codes for SYS_EX
- Complex processes – link tables, device parameters, discovery
- This is the **interesting protocol**

Remote Management (REMAN) :

- the SYS_EX telegram and structure definition
- Basic processes and function

Remote Commissioning - Use Cases

- **Set Up -** During commissioning of newly installed networks

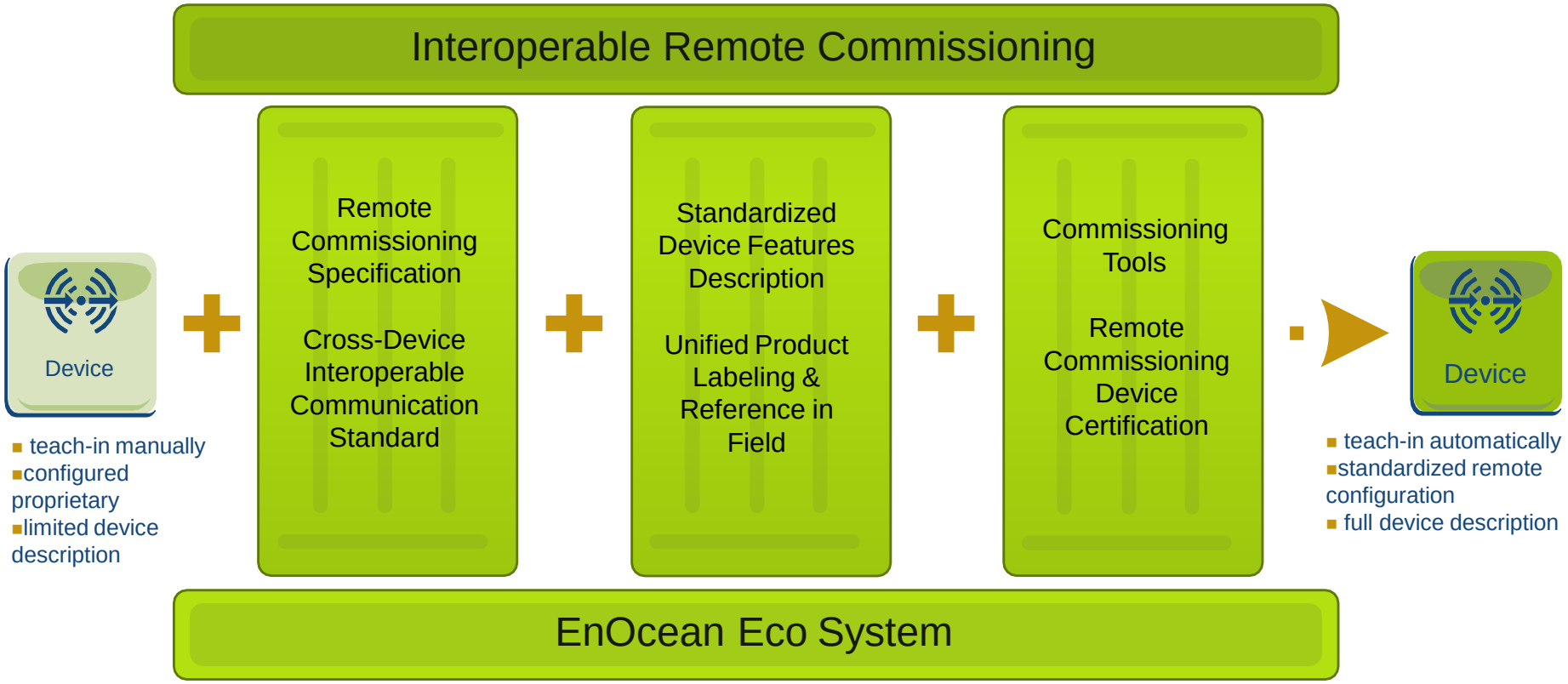


- **Maintenance** - When modifications, by adding and removing devices and/or changing devices' configuration parameters.

- **Replace** - When replacing a non-operating device with a pre-commissioned, ready to install one.

- **Troubleshooting** - When trouble shooting an operating EnOcean network.

Three pillars



Get Product Id

Commissioned device

1. Scan Product ID and EnOcean ID

https://www.qr-code-generator.com/

Get Device Description file

1. Query Device Description File with Product ID
   https:\\enocean-alliance.com\ddf\[MAN-ID]\[PRODUCT-ID]

2. Get DDF - XML

Use case – Linking

1. Scan the switch

2. Add switch to Link Table

3. Switch will immediately work

Use Case - Paramters

Set temperature in HVAC

Dimmer settings

Energy settings

Control panel set up

Timers in occupancy

Smart Acknowledge

Smart Acknowledge

Smart acknowledge bi-directional communication between a self-powered device and a line-powered device..LinePowered: In reference to equipment that is electrically **powered** by the telecommunications circuit to which it connects, thereby eliminating the need for local **power**.

1st : **Measurement Value**

(e.g. temperature, humidity, set+, set-)

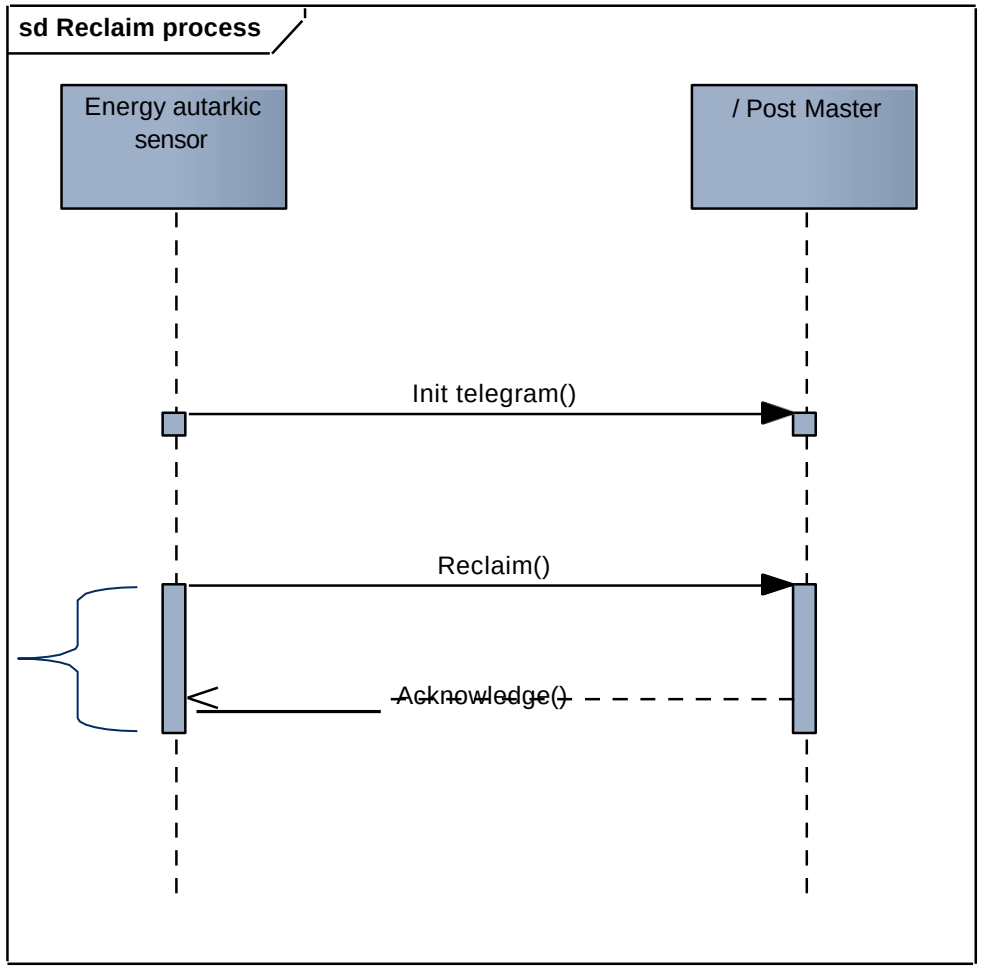
2nd (SMART ACK): **Parameter Update**

(e.g. display value, set-point zero, display "window open!")

Smart ACK Principle

Extremely short time interval

Only here the receiver is switched on!



Security

Security level survey

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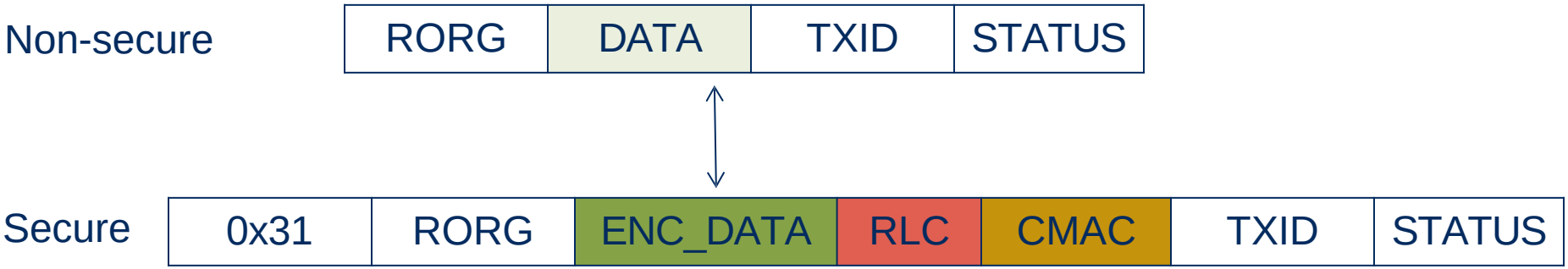
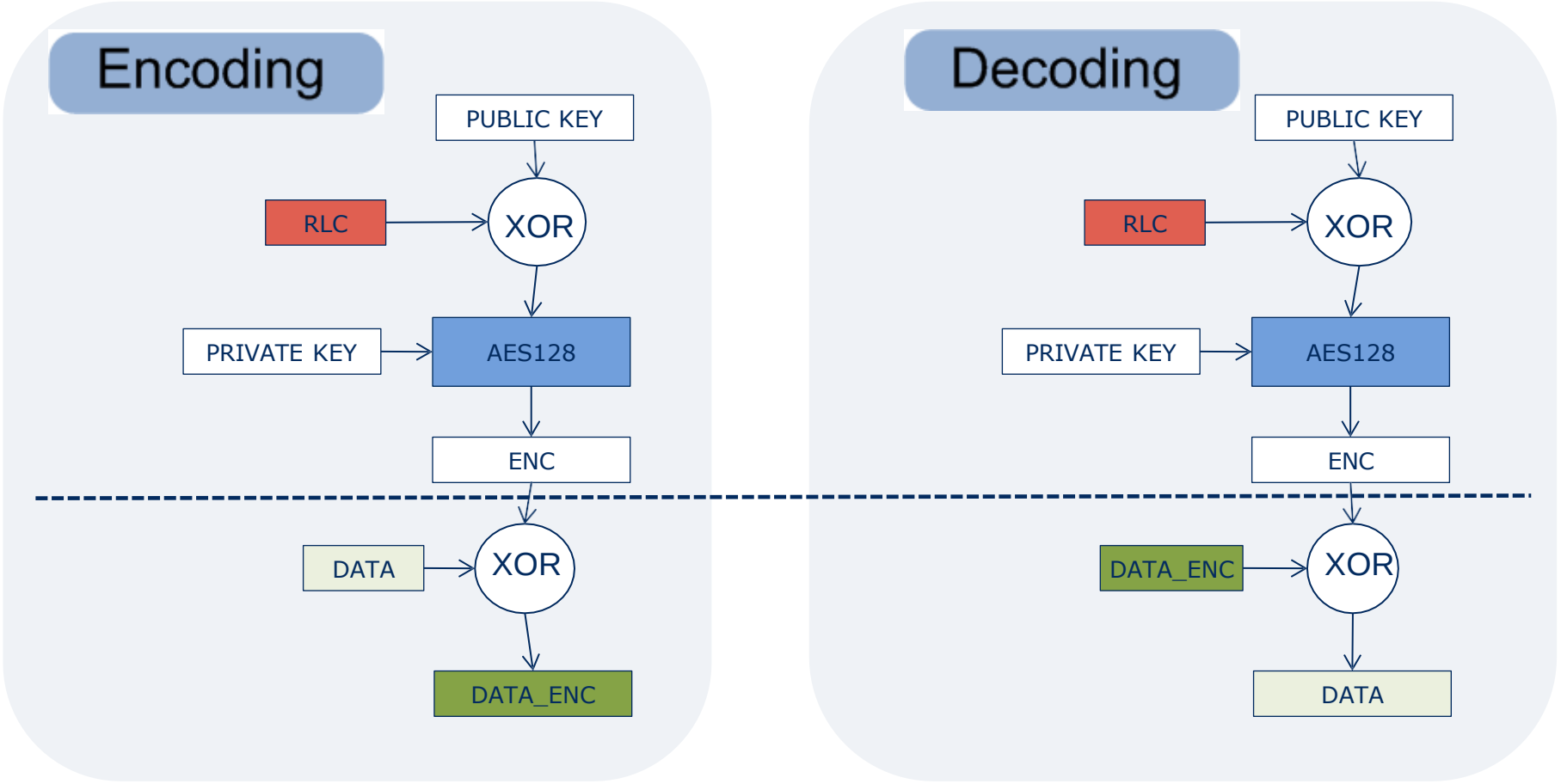
	Metering Products (Sensors)	**Comfort & Energy Saving Products (Controls power consuming or –generating devices)**	**Safety & Security Products (Protecting high value assets or human life)**
Confidentiality	AES encryption	AES encryption	AES encryption
Authenticity	AES CMAC with counter	AES CMAC with counter	AES CMAC with counter
Integrity	AES CMAC	AES CMAC	AES CMAC
DoS Protection	Absence & Relay detection	Absence & Relay detection	Absence & Relay detection

- Telegram encryption (hide meaning) and authentication (avoid unauthorized control)
- EnOcean score high in Fraunhofer (AISEC) security survey

En- \ decapsulation of non-secure RORG



VAES



PUBLIC KEY is for all devices same
= 0x3410de8f1aba3eff9f5a117172eacabd

EEP / Signal Telegram

enOcean Equipment Profile

EEP / GP (Application Interface)

EEP

What is it

- "Translation between Bytes and Meaning"
- Mechanism to encode / interpret EnOcean telegrams based on a "magic number"
- Foundation for functional interoperability between products

- What should be done
  - Number of defined EEP keeps growing, but support for new EEP is limited
  - Short term item is to separate status & configuration from normal reporting
  - Long term item is secure application level interoperability and next gen profiles

Signal Telegramm

Extending devices EEP functionality with common features.

Energy storage at: **80 %**
Energy harvesting conditions are: **“very good”**

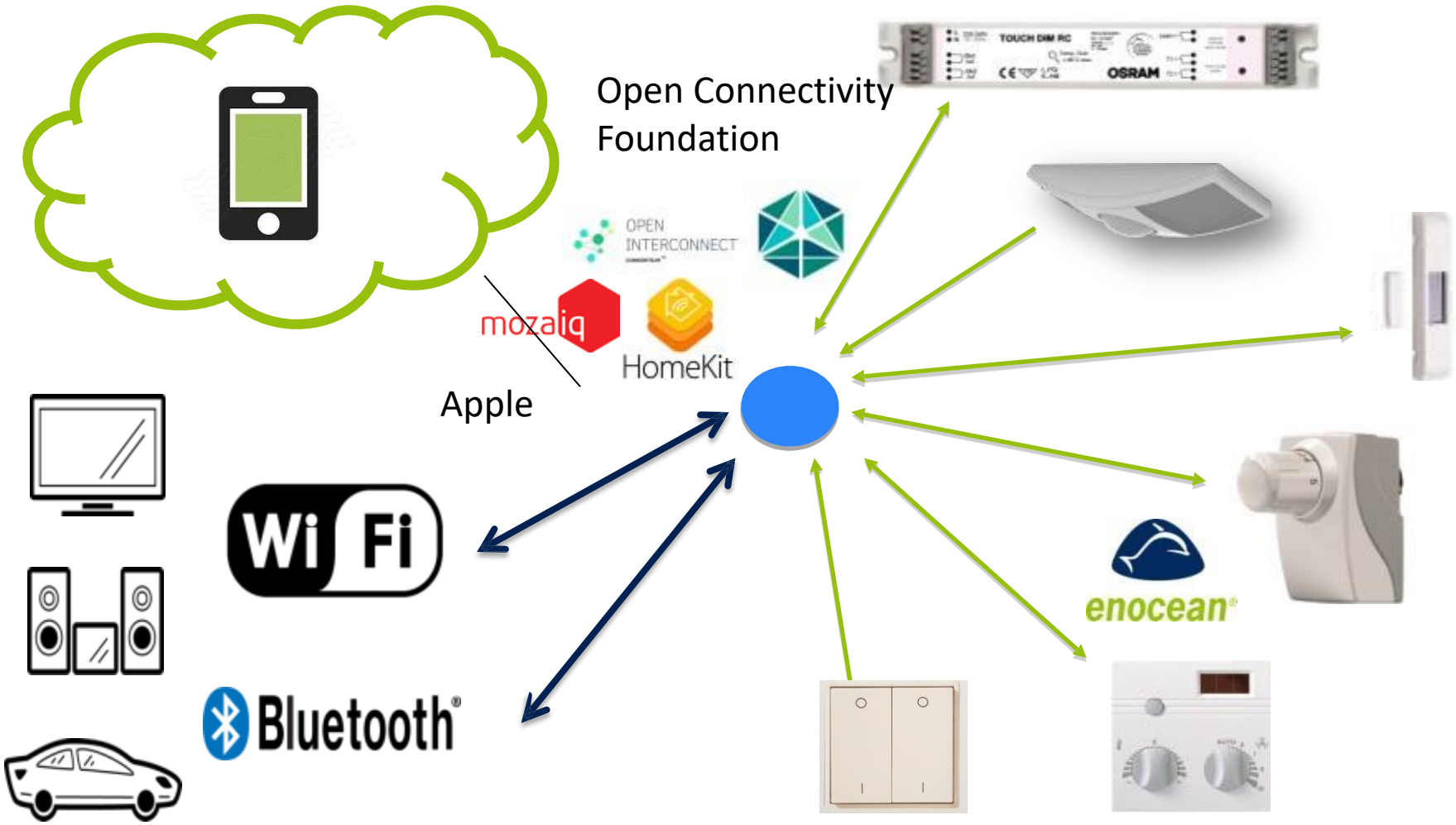
Trigger: **last device status**

Signal: **device status**

I can hear:
10 IDs with **very good** radio quality
5 IDs with **average** radio quality

EnOcean over IP

IoT - All about connecting devices



Representation of EnOcean devices in IP – mostly EEP related

REST Api, JSON Data Model

Nr.	JSON model
1	systemInfo
	version of Interface with EnOcean base information
2	profile
	EEP functionality / functions: Which information will send a specific profile or device and which states can be set?
3	device
	informations about known devices of the Interface
4	telegram
	incoming and outgoing telegrams
5	state
	saved states of devices

https://www.enocean-alliance.org/wp-content/uploads/2017/05/EnOcean_Equipment_Profiles_EEP_v2.6.7_public.pdf

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REST route	HTTP method
/devices/states or /device/{deviceId}/stream	GET


```
{
  "header" : {
    "status" : 200,
    "content" : "states",
    "timestamp" : "2015-08-11T18:10:15.574+0200"
  },
  "states" : [ {
    "deviceId" : "019604F9",
    "friendlyId" : "valve",
    "functions" : [ {
      "key" : "setPointInverse",
      "value" : "0",
      "valueKey" : "false",
      "timestamp" : "2015-08-11T18:09:54.115+0200",
      "age" : "21459"
    }, {
      "key" : "valve",
      "value" : "15",
      "unit" : "%",
      "timestamp" : "2015-08-11T18:09:54.115+0200",
      "age" : "21459"
    } ]
  } ]
}
146
{
  "deviceId" : "019604F9",
  "friendlyId" : "valve",
  "timestamp" : "2015-08-11T18:11:24.205+0200",
  "direction" : "from",
  "functions" : [ {
    "key" : "valve",
    "value" : "0",
    "unit" : "%"
  } ],
  "telegramInfo" : {
    "data" : "8",
    "status" : "0",
    "dbm" : -45,
    "rorg" : "A5"
  }
}
```

Certification

Certification

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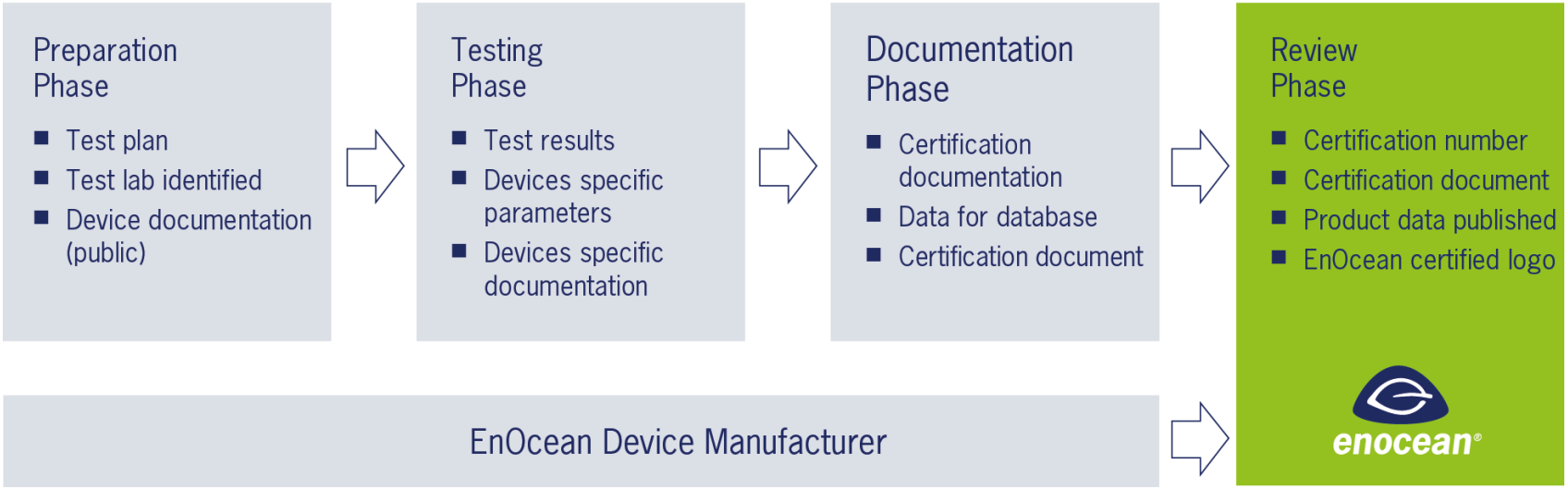
Overview of EnOcean Alliance Certification Process



Certification Versions

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- Air Interface Certification

"Certified Platform"
Only for module & platform manufacturers.

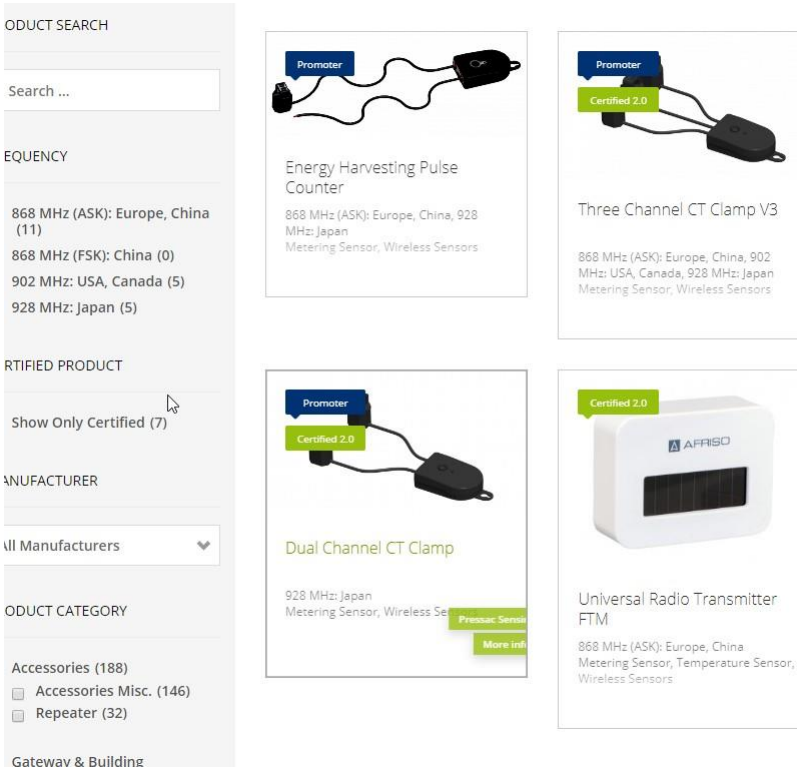
- Air Interface Certification
  + Profile Declaration

"Certified Product 2.0"
Only for legacy products.

- Air Interface Certification
  + Profile Certification
  + Energy Harvesting Certification (Dec 17)
  + Radio performance Certification (Nov 17)

"Certified Product 3.0"
For all new products. Legacy products optional.

Self-Certification. Low Effort. Low / No Cost.



- EnOcean Alliance Certification Manager
  Armin Pelka

certification@enocean-alliance.org

- Certified Product Database

https://www.enocean-alliance.org/ja/products/

Labeling

Labeling

What is defined?

- Label content is separated into fields (according to ANSI MH10.8.2-2010)
- Label shall be machine readable too
- Mandatory Fields:

Product ID
6 bytes

Manufacturer Assigned

EURID
4 bytes

Module manufacturer assigned

- Optional Fields:

AES Security Key
16 bytes

Recom code
4 bytes

Manufacturer tags
…

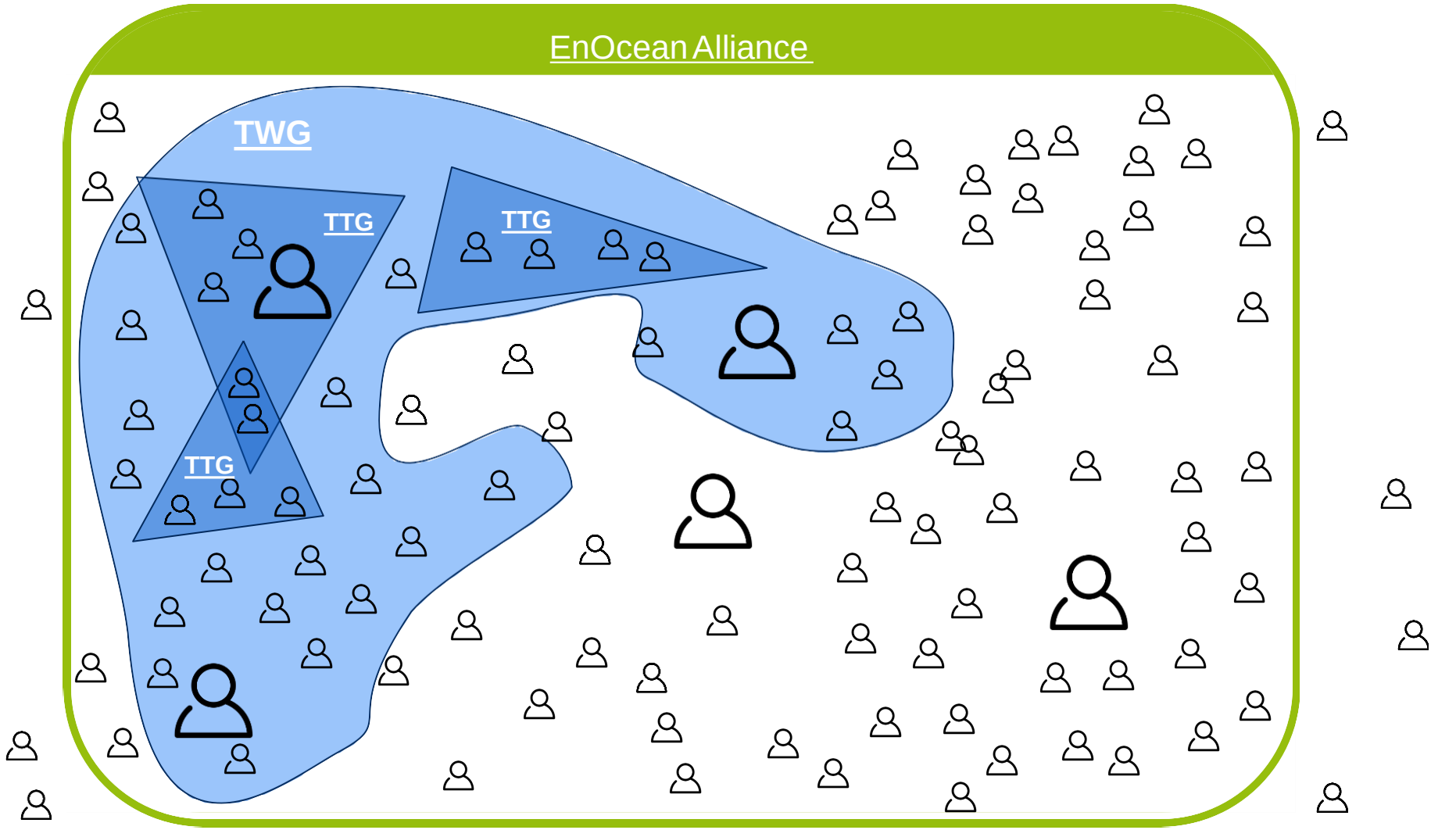
Labeling

What is up to the manufacturer?

- Label type – NFC, QR, BAR etc.
- Label properties: pixel size, coding, dimensions
- Label position

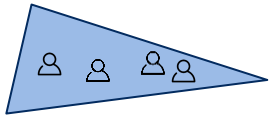
How the TWG Works

Organisation

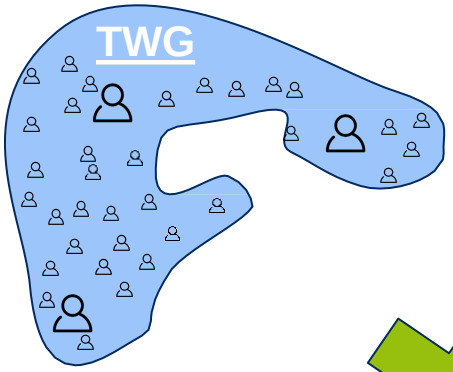


TWG – Technical **Work**group
TTG – Technical **Task** group

Rules of the Game.. For content creation



TTG Create 6-12 Months
(exclusive access)



TWG Approve 4 weeks

Focus 2018

Focus 2018

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Technical Task Groups

Remote Commissioning

EEP – Communication Profiles

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Strategic initiative

EnOcean IoT

Focus 2018

Remote Commissioning & Remote Management

- Secure communication
- Range Extension over repeater
- Range Extension over multiple hops

- Device Description File – extension promotion amongst members

TTG Head:

EnOcean

ViCOS

Focus 2018

EEP Communication Profile

- Definition of Signal Telegram and associated features
- EEP v3 – new concept – long term

- Simplified EEP Specification release process
- Tool for profile submission and description

TTG Head:

TWG Chair

Focus 2018

Security

- Incorporate (bidirectional) high Security concept to existing specification
- Review and extend existing features
- Secure communication inside Recom

TTG Head:

EnOcean

Focus 2018

Labeling

- Review standard for multi-purpose protocol use
- Promote standard to members
- Incorporate feedback and expand

TTG Head (Specification owner):

EnOcean GmbH

Focus 2018

EAC – EEP Approval Committee *(Program)*

- Ongoing meetings and review of new submissions of EEPs
- ensure high quality standards
- active support interoperability

- EAC Program Updates - New Profile submits include:
  - Test for EEP Certification
  - IP Representation

Program Head:

Diehl

Certification program

- Add Energy harvesting specification to the list of specifications
- Promote Certification v2.0 & 3.0
- Extend existing product database

Certification Manager:

Armin Pelka

Focus 2018

EnOcean IoT

- Initiative to introduce **new generation of devices** with IoT features

- Short Term goals:
  - Include IP Description of additional EEPs

- Mid Term goals:
  - Certification 4.0 – application behavior certification
  - Database of Device Description Files – *electronic datasheet*
  - Mandatory Product labeling according to specification
  - Next Generation EEPs 3.0
- Alliance approved commissioning tool

Head:

Digital Concepts, ViCOS, EnOcean

Next gen EEPs – Ideas

- EEP 3.0
  - Similar to IP representation of Profiles

Few ideas

- Fixed ranges & scaling for all future profiles
  (endless variance caused more pain than gain)

Temperature	**10 bits**	**0.1 Steps**	**-40° C to 60° C**

- Atomic functions (no complex hidden process)

- Status reports & synchronization & acknowledges

IoT - All about connecting devices

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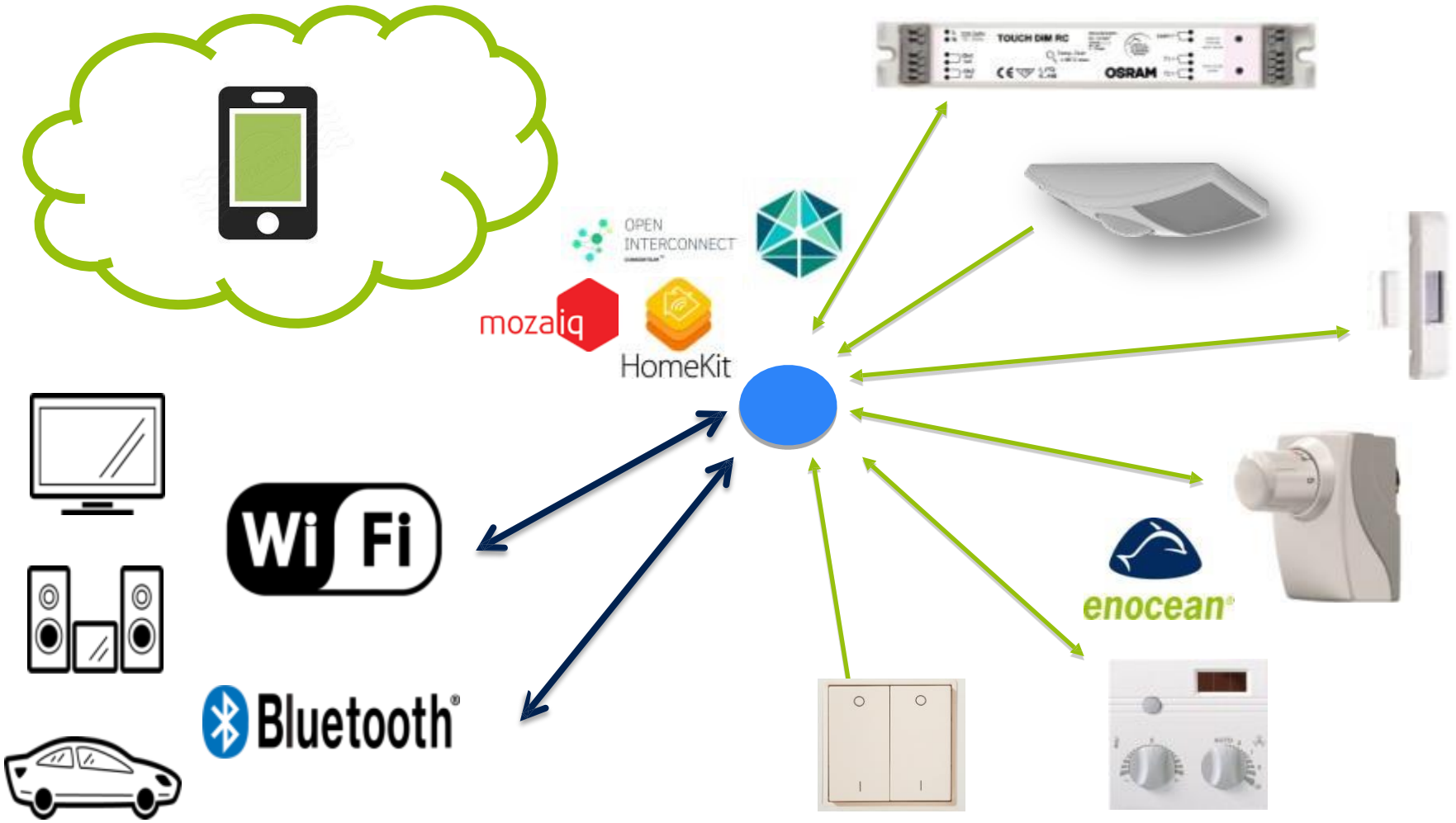
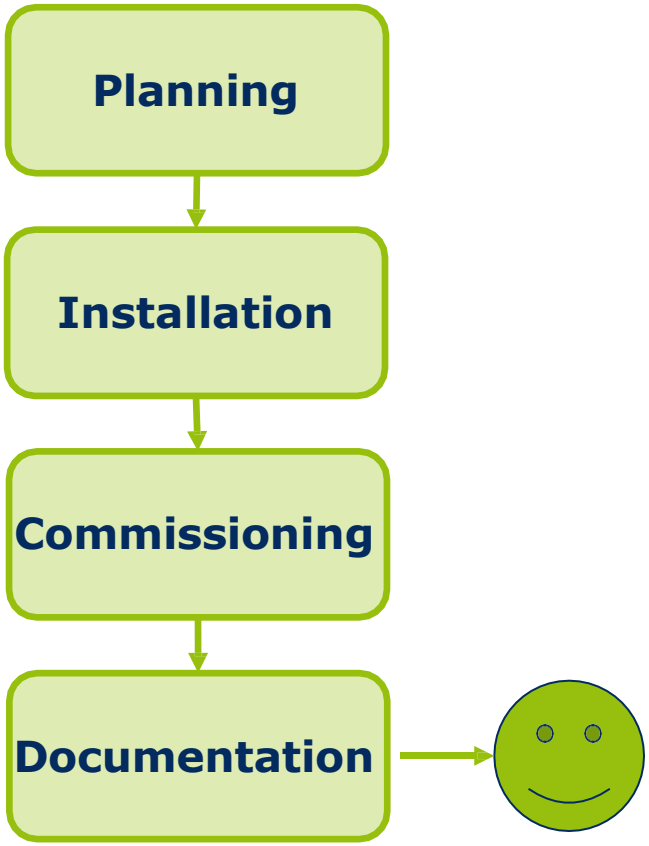


Installers Tool



Key features:

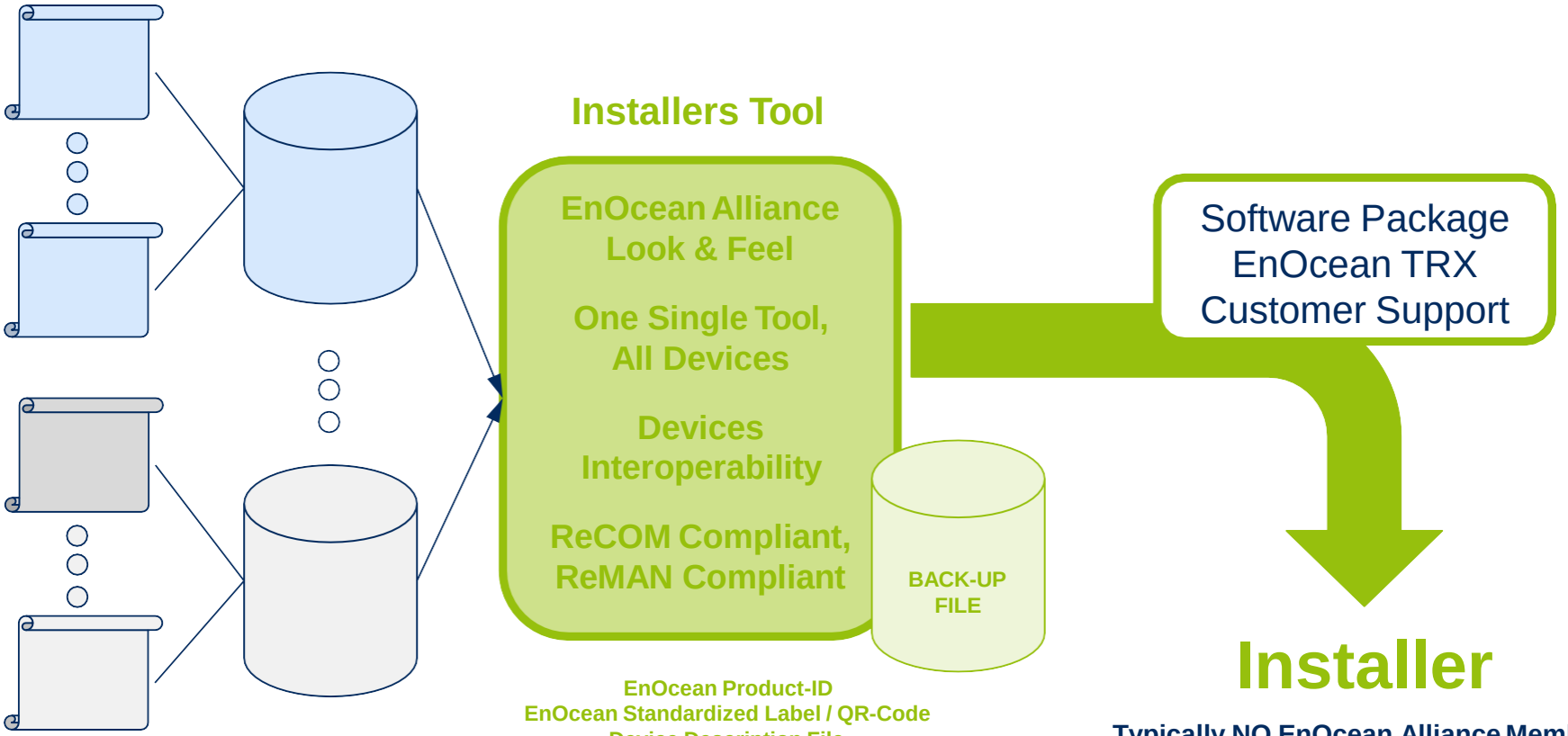
- Precise end application identification - Product label
- Electronic data sheet
- Device complies with certification and IoT ideas
  - Atomic functionality
  - All parameters can be read / write
  - Status of synchronized over all user interface (display, phone, cloud)
  - Application decision take outside end-devices
- Remote commissioning support
- Documentation: Back Up file

Installers Tool – Implementation Scenario

Product Manufacturers Distribution Channels

EnOcean Alliance Tool Manufacturer

Product Manufacturers Distribution Channels



Electronic Datasheet

Describes all features and aspects of the end product with given semantics – configuration parameters

Publically available

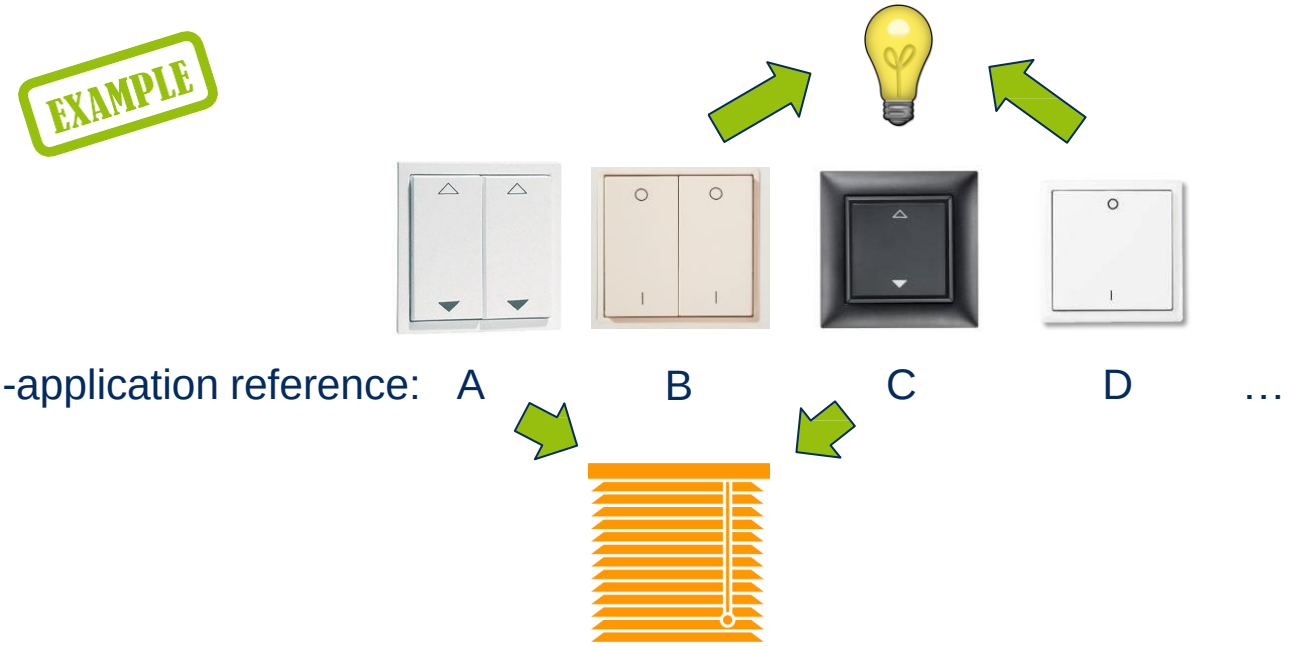
Standardized form


```
<?xml version="1.0"?>
<xs:schema>
<!-- need to do the schema definition, namespace, etc -->

<xs:element name="Device"> <!-- does this have a type? -->
  <xs:complexType>
    <xs:sequence>
    <xs:element name="Manufacturer_Name" type="xs:string"/>
    <xs:element name="Manufacturer_ID" type="xs:string"/>
    <xs:element name="EEP" type="xs:string"/>
    <xs:element name="GP" type="xs:string"/>
    <xs:element name="Name" type="xs:string"/>
    <xs:element name="Desc" type="xs:string"/>
    <xs:element name="Firmware_Version" type="xs:string"/>

    <xs:element name="Supported_EEPs" maxOccurs="unbounded" minOccurs="1">
      <xs:complexType>
```

Precise end-application identification

Requirement for perfect and seamless operation:

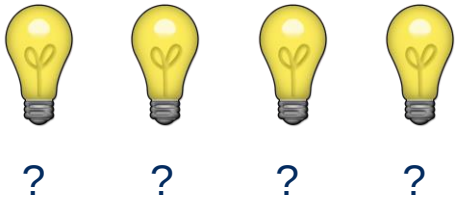
Precise end-application - Specific for final look & features



Localization in field

Localization (e.g. in room) is required for remote set up

network identification (communication ID)



EXAMPLE

ACTION: Localize Z

Communication ID	Product reference
X	Light
Y	Light
Z	Light
W	Light

Source: https://icondoit.files.wordpress.com/2010/04/nm_lightbulb.png

EnOcean becoming Things

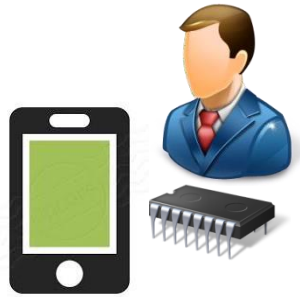
Product

a. Scan communication ID and application identification

b. Get via air

2. Query Electronic Datasheet with End-application reference

XML 



3. Commission Device

Product

EnOcean becoming Things.

Key:

- **Specific end-application description**
- **Identification in field**
- **Remote control of features and configuration**

IoT Spec – Coming up

- EnOcean over IP
  - First Specification that lays the groundwork for a complete IoT Spec
    - Describes the communication behavior of a gateway between EnOcean Radio and IP-World
  - Doesn´t specify the behavior of devices (actuators, sensors)
  - Doesn´t specify organizational rules for an End to End (Device to User Interface) usage

- Why we need a IoT Spec.
  - EnOcean has to reflect the changes and progresses in the IP/IoT world for the Ecosystem to grow and prosper.
  - First Paper Created: EnOcean devices becoming Things_IP Regulations V0.4
    - Quick look through to get the idea…

- What should be part of the IoT Spec
  - EnOcean Specifications 2.0, 3.0
  - EnOcean over IP Spec
  - Existing Specifications need to be extended
  - New Specifications have to be created.

IoT Spec –Content excerpt ...

- Physical, Data, Network Layer
  - Timing behaviour GW <-> Device
    - Timeslots in Adressing of devices (100 ms)
    - Burst Avoidance
      - GW -> Dimming with slider
      - Device -> State reports blind actuator
  - Remote Management/Remote Commissioning extension: ReMan/ReCom over repeater (similar: From Hub to Switch) ReCom: 2-Channel Actuator -> Which Switch for which channel ? ReCom: Integration of application logic into ReCom definition
  - Addressing of devices with ADT, answer of devices with Broadcast)

- Transport, Session Layer
  - Existing Security
    - Key Exchange over the air …
  - Security "Plus" or 2.0

- Presentation, Application Layer
  - Ack after Receive
  - Ack after Execution

marian.honsch@enocean.com

Contact
For further information
please feel free to contact us

EnOcean Alliance
2400 Camino Ramon, Suite. 375
San Ramon, CA 94583
USA

info@enocean-alliance.org
www.enocean-alliance.org

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